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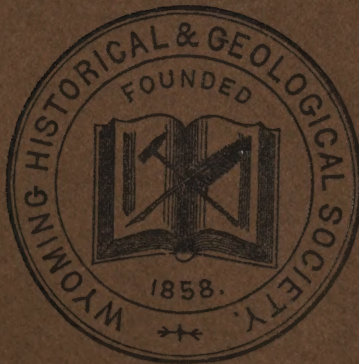


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GIANT POWER

AN ADDRESS BY
F. H. NEWELL



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VOLUME XX

GIANT POWER.

AN ADDRESS BY F. H. NEWELL,

BEFORE THE WYOMING HISTORICAL AND GEOLOGICAL SOCIETY, WILKES-BARRE, PA.,

SEPTEMBER 29, 1925.

What is giant power and why should this Society be interested? These are pertinent questions and deserve careful answers. In fact, as we try to put into words the answers to this "What" and "Why", we find that far from being an abstract proposition of academic interest we are brought face to face with some of the largest pending problems affecting each one of us in our business and in our homes.

First, as to why this Society is concerned in such matters:

What have history and geology to do with these problems of to-day and to-morrow? The answer is, everything. Our plans for this month and next year all rest on our knowledge of what has happened in the past. We assume that the sun will rise to-morrow because it always has done so since the world began. We plan for meeting our taxes because history has shown that these are the inevitable accompaniment of civilization. We arrange for continuing our mining and industrial operations in certain places because our knowledge of geology shows that there are certain age-old elements of success. In short, the more we know of recent and past history, reaching back through human affairs and finally into the story of the earth and its mineral resources, the more certain we become that we are on the road to success.

Your Society, in its long years of activity, has done perhaps more than its share in laying the firm foundation of facts upon which others have built. You have stimulated, by your meetings and publications, many thoughtful men and women of whom you may never hear but who have made practical use of the knowledge imparted, or have passed it on to others. You have developed certain ideals and idealism which have helped as a guide and light to the difficult paths of present progress. For this reason it seems particularly de-

sirable that at this time you take up and diffuse information upon some of the immediately pressing questions involved in this term "giant power."

From the time of the childhood of the race we have delighted in stories of giants and of great forces. Who of us has not been thrilled by the tales of friendly giants who have helped in distress or of heroes who have attacked and overcome the bad giants? The present generation revels in stories of captains of industry and in the big figures, the millions and billions involved in gigantic business operations. Each large city is striving to become still larger and to surpass its competitors, if not in size, then in height of buildings or magnitude of financial transactions. We still have a certain childish delight in big things and at the same time we are a little afraid of them. We have a childish fear, simply because they are big and challenge our imagination. Roosevelt recognized this when he said that big business was not necessarily bad because it was big. At the same time we appreciate that great size in itself does bring in new problems such as were not met by our predecessors and are not put down in our text books.

The present generation differs from all that have gone before in the increase and still rapidly growing use of mechanical and electrical power. We are at the beginning of the "Age of Power," of gigantic forces which are doing more wonderful things than the genii who came at the rubbing of Aladdin's lamp. The problem of our future is largely in the hands of the man who holds the lamp, and thus controls the genii. The quantities of power now developed, in the aggregate, are so big as to be little comprehended by the ordinary citizen and yet we know that these mechanical and electrical genii are still in their infancy. They have just begun to come into their own. Who will be the master? Will it be all of us, or will it be a small group of self chosen directors?

Throughout all time, to almost within our own recollection,

as shown by your historical notes, about the only forces available to the ordinary man, outside of his muscular strength, were those of the horse and other domestic animals. The farmer up to the present has had to depend almost wholly upon his own strength and that of the members of his family or hired man. By the most unremitting back-breaking toil he has been able to produce from the soil little more than enough to sustain the life of his family and of his hired workers and draft animals. As he utilized more largely the strength of horses and employed machinery which could be operated by horse power, his productive capacity increased. He found that he could feed more people. But even the use by the farmer of horse-driven machinery has made relatively slow headway except in the most advanced communities. This progress, however, has been sufficient to bring in new and difficult problems and has resulted in the reduction of area cultivated throughout large parts of the United States: this relative reduction of cropped area is bound to continue at an increasing rate as mechanical and electrical power becomes more and more available on the farm.

In short, in every occupation, beginning with the most primitive of all, farming of the soil, and continuing through mining and all the other industries, there are arising these problems, coming about from the larger use of mechanical and electrical powers; yet history shows us that, in one sense we are only at the beginning of a new set of questions.

The magnitude of the forces at work may be most simply shown by the statement that in the central stations throughout the United States there is now a capacity of twenty million horse power and in five years there will be needed a capacity of approximately thirty-six millions horse power for industrial and domestic purposes; requiring an additional investment of \$5,000,000,000 in various enterprises. (Hoover, Sept. 18, 1925).

The point to be emphasized at this time and the object for which we have come together is to consider whether with

large knowledge of the magnitude of the problems, we can more effectively "do our bit" toward helping the earliest and best solutions of these problems growing out of the ever widening use of power. If so, how can we do it? The answer is in knowing broadly the facts, in considering the tendencies of the times and in applying the principles successfully tried out by our predecessors.

In speaking of power and its uses our first question is as to where it comes from; how is it obtained? There flashes on the mind the picture of Niagara and the millions of potential horse-power in the falling water. Then we recall the many other water powers or rapids of less magnitude, and the innumerable rivers whose waters, held back by large dams might be available for hydroelectric power. In the popular mind there is enough water power unused to turn all the wheels of industry and of commerce. The facts are, however, that the careful measurements of rivers now available for power, or that might be used, show that the volume of flow is below the present or prospective needs. If every river in the United States were put to its full use, there would still be necessity of burning annually millions of tons of coal to create power for present needs.

In the State of Pennsylvania there are estimated to be about 700,000 horse power to be had from the rivers flowing idly to the ocean. Only a portion of this can be economically developed since the first cost and maintenance of the necessary dams and other expensive structures far exceeds the comparable cost of installation and operation of steam electric plants dependent upon the burning of coal, obtainable to the extent of billions of tons from the Pennsylvania fields,—enough for several hundred years at the present rate of use.

The accompanying diagram, FIG. 3, has been prepared to give a comparative view of the location and extent of the coal fields of Pennsylvania, also of the existing steam and hydroelectric plants in operation or proposed. The number and size of the steam plants may be indefinitely increased,

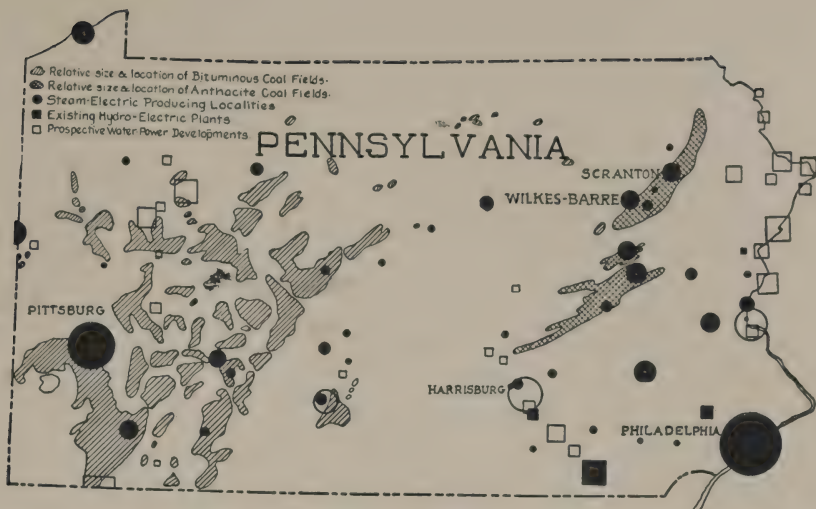


FIG. 3. COAL FIELDS AND POWER PLANT LOCATIONS IN PENNSYLVANIA.

The single cross hatched areas show the relative location and size of the bituminous fields; the double cross hatched are the anthracite fields. The circles indicate the principal steam-electric producing localities and the squares in solid black, are the existing hydro-electric plants; the squares in outline only are prospective water power developments, the size indicating the relative importance. (See p. 247).

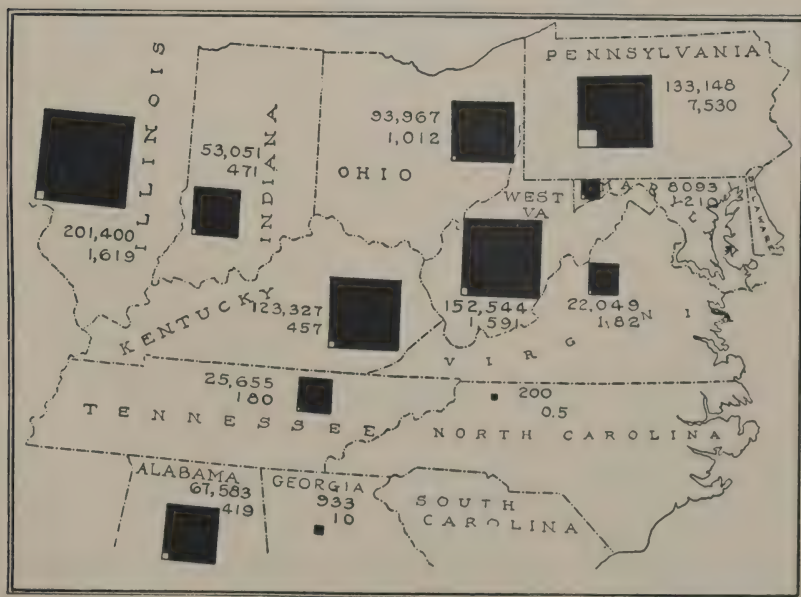


FIG. 4. AMOUNT OF COAL AVAILABLE IN CENTRAL AND EASTERN UNITED STATES.

The large black squares in each State give the relative tonnage in the ground down to the 3,000 ft. level, as shown in the upper set of accompanying figures in millions of tons. The small white squares in the lower left hand corner of each black square show the relative amount mined to date, as given in the lower row of figures. That is in Pennsylvania, there are estimated to have been 133,148,000,000 tons of which 7,530,000,000 have been mined. (See p. 248).

but the water power plants are limited and are steadily decreasing in number as steam electric power replaces them. The cheaper power from central stations and the interconnected transmission lines have put out of use hundreds of the smaller widely scattered water powers, as well as thousands of steam engines.

Will not the Pennsylvania coal supply be exhausted? The best of it, that is the thicker beds, may give out in a few generations or a century, and the mining of the thinner beds may give rise to difficulties. But Pennsylvania is only one of the many States, each having large deposits of workable coal, as indicated on FIG. 4.

If we indulge in a few figures of big business, we find that according to the latest United States census there were in the United States over 105,000,000 people, or more than 24,000,000 families living in over 20,000,000 homes. These people, in their industries and occupations, used last year over 60,000 million kilowat hours, generated largely in central power stations with a capacity of over 20,000,000 horse power.

To erect the necessary machinery an expenditure of over six billions was made, and from this last year a gross revenue of a billion and a third dollars was had. A total of 16,000,000 customers was served, and of these customers nearly 300,000 owned an average of seven shares in the business. Comparing municipal plants and those commercially owned, it appears that the municipal plants supplied less than five per cent. of the total output.

The voltage has steadily increased from a maximum of 4,000 volts in 1889 to 220,000 volts at the present time. The mileage of transmission lines in the United States has grown to 102,000 circuit miles and the distribution to 417,000 circuit miles. The electric power and light companies have over 155,000 employees. About 40 per cent. of the population of the United States lives in electrically lighted dwellings, but less than 2 per cent. of the railroad mileage of the country is

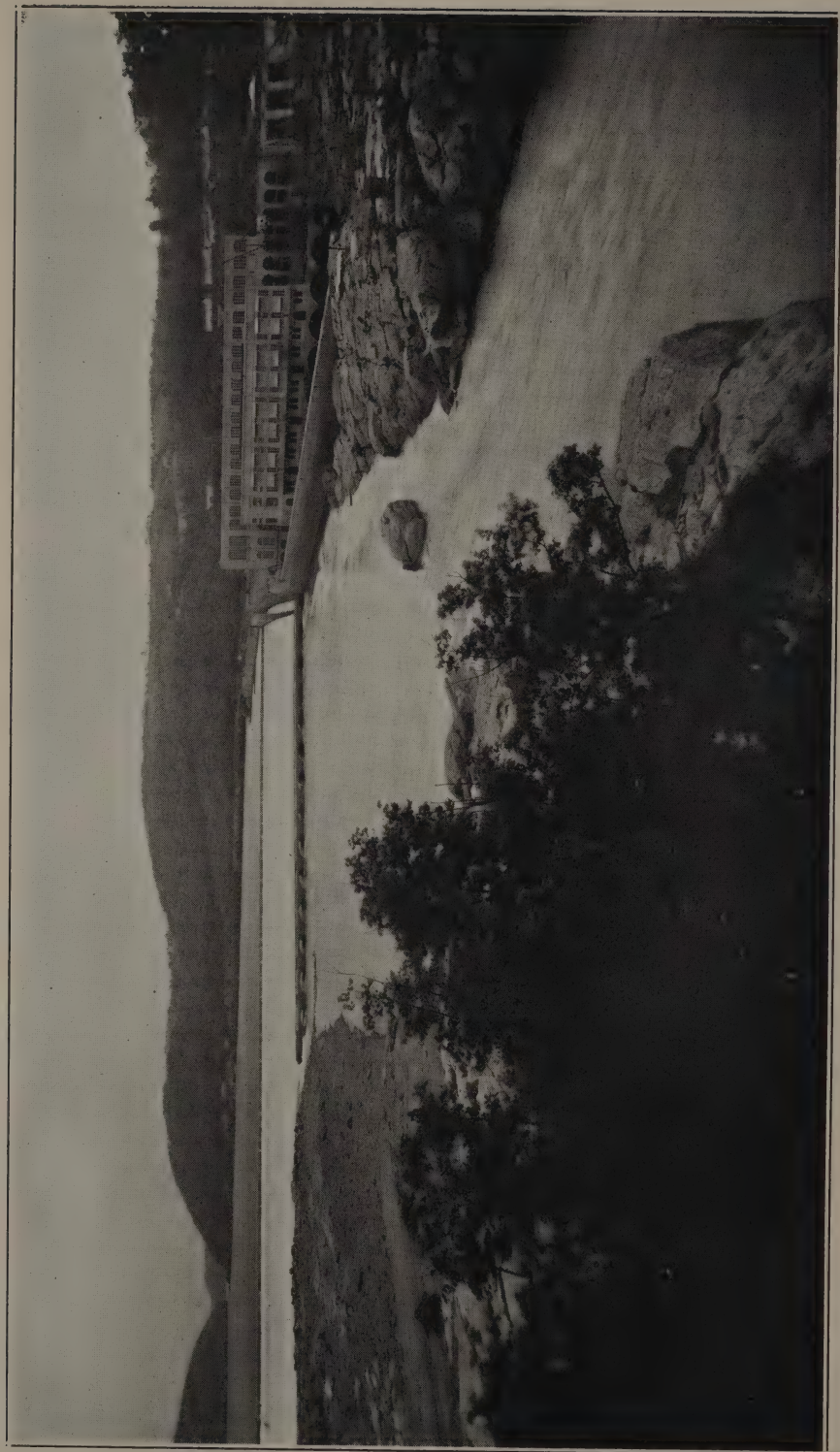
electrified. Of the 6,000,000 farms in the United States, about 12 per cent. are supplied with electricity.

Coming back again to the State of Pennsylvania; about a fifth of the area of the State has access to electric service, but 75 per cent. of the population is within this area, which may be supplied from existing power lines. The farms of the State are largely without access to electric service, but 75 per cent. of the population is within this area, which may be supplied from existing power lines. The farms of the State are largely without the benefits of electric service, since of the 200,000 farms only about 12,000, or 6 per cent., have electric utility service. The rates and conditions of service on the farms have been notably high as compared with large sections of agricultural land in Canada, Wisconsin, California and elsewhere, where, with more moderate rates for service, the farmers have become important users of current.

Of the total current delivered to all consumers in Pennsylvania less than 10 per cent. is for so-called domestic use. It is thus apparent that the present development of the electrical industry is mainly for power purposes, and not for lighting. Two-thirds of the industrial power is applied electrically.

The electric power now sold in Pennsylvania is derived mainly from the burning of coal, 89 per cent. being generated by fuel and only 11 per cent. by water power. Studies of the water resources show that the water power possibilities in Pennsylvania will not supply more than about 10 per cent. of the power requirements of the State. It is evident, therefore, that we must look to the use of coal for power, and this in ever-increasing quantities.

Within the State there are already in service transmission lines of 220,000 volts, and others of this voltage are planned. This permits of the transmission of large quantities of electric power without serious losses for upwards of three hundred miles. The distance across the State, that is from Pittsburgh to Philadelphia, by rail is almost three hundred and fifty



Water Power Plant of the Pennsylvania Water and Water Power Company, at Holtwood, on the Lower Susquehanna River.

miles. The total cost of transmitting electric power from the Pittsburgh district to the vicinity of Philadelphia is placed at less than 1.2 mills per kwh.

Each power system in Pennsylvania built its own relatively small power station independently of all others, and with regard mainly to immediate profits, and with little consideration of future combinations or of the cheapest possible conditions which may be available. Of the electric current sold in Pennsylvania, 98 per cent. has been produced by systems controlled by fifteen holding companies, and about 2 per cent. has been supplied by 155 local companies and fifty-five municipal plants. There is a tendency towards consolidation, and in a few years there will be fewer, possibly only one or two companies, or groups of individuals, controlling virtually the whole electric power business of the State.

The reason frequently given for transporting the fuel from Western Pennsylvania to the large power stations on or near the sea-coast is the fact that enormous quantities of cold water are needed for economy in operation in condensing the steam used in the modern high-power engine. For every ton of coal burned from 400 to 600 tons of water are required. It is commonly stated that very large power plants cannot be operated economically in the vicinity of the coal mines because of the lack, during the dry periods of the year, of these necessarily large volumes of water. A study of the conditions, however, shows that cooling or condensing water can be made available in sufficient volume in Western Pennsylvania to make operation possible. This can be done either by locating the power stations along the Allegheny or Monongahela rivers, or on the Ohio itself below Pittsburgh, or by using devices such as storage reservoirs, circulating ponds or cooling towers such as are built by large power plants in European countries, dependent upon small streams.

The waste in fuel, by hauling the coal from the vicinity of the mines to the sea coast, may be more evident if we picture to ourselves the long lines of coal cars and appreciate that a

third of the total ton miles of freight hauled on the railroads in Pennsylvania consists of coal to use in the State. Also that three times as much coal is being burned in the steam locomotives of the State as would be used if the railroads were electrified, and continued to haul the same amount of traffic. It is estimated that by electrifying the steam railroads it would be possible to save seven and a half million tons of coal each year in Pennsylvania alone.

The greatest saving, however, will come about when it becomes possible to burn for fuel not the "raw" coal but a prepared fuel from which has been taken the valuable by-products which are now wasted, wherever high volatile bituminous coals are used. Many of these possible by-products go up the chimney in the form of smoke or soot from the imperfectly used coal. They become a nuisance and an actual injury to health and property, to an amount of millions of dollars a year.

The pre-treatment of bituminous coal on a large scale, most economical for giant power plants, will supply large amounts of gas which may be made to take the place in part of the failing natural gas. It will also furnish acceptable gasoline for auto and other internal combustion engines. Among the other by-products may be the tars and pitches for road building, ammonia for fertilizer, and other substances for all of which there is an increasing market in the face of the early decline in the natural supplies of these materials. Our present wasteful methods of consuming the highly volatile bituminous coal will be looked upon by our descendants as an instance of the prodigality of the present generation, one not far removed from barbarism. They will look back upon us with our (to them) inexcusable waste, as we now look back upon our predecessors who ruthlessly destroyed the forests.

Your studies of the history of this valley, its settlement and the development of its industries, supplemented by your knowledge of the geology and mineral resources, enable you

to take a long range view of these things and to comprehend perhaps more clearly than many others that there is a steady, continuous unfolding of events, and of methods of evolution which is going on with increasing rapidity, particularly in the mechanical lines, bringing in great benefits and at the same time containing the seeds of social decay. We know from looking back on the past that we cannot stop this progress, even if we would, but that we can direct it upward and onward for the larger benefit of humanity as a whole, or, by neglect, we can let it trend downward to our injury. That is, we may guide and direct, but we cannot stop the changes which are taking place. It is of vital importance to us that we know something of the magnitude of these changes and of the forces which control them.

In these discussions of the development and best use of mechanical and electrical power, we find that there are two terms in common use, apparently interchangeable and yet having widely different significance, as great, for example, as between Republican or Democratic forms of government. To the citizen on Main street it makes little difference whether the orator speaks about a Republican or Democratic form of government. It is all the same to him and yet to the statesman there is a vast difference. In the same way we talk loosely of these great forces just described, and refer to them as "superpower" or "giant power", meaning practically the same thing, yet there is as great a difference in the minds of statesmen as there is between the words Republican or Democratic government.

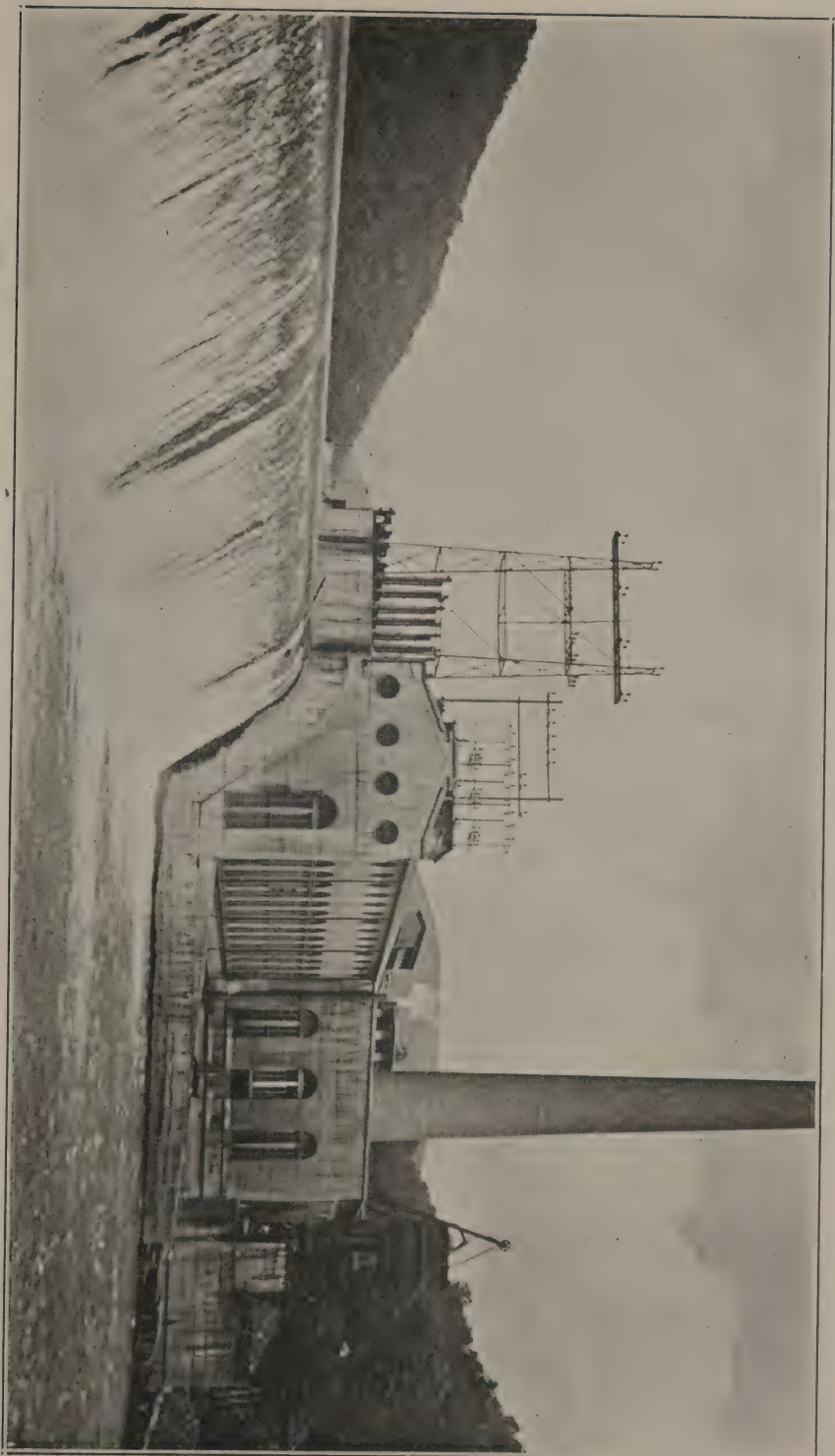
In the term "superpower" we include the great development which is now taking place, in which larger and larger generating stations dependent upon water power or steam power are being built, and larger and longer transmission lines constructed, not merely distributing power but connecting with each other, until there is rapidly extending over the United States a network of inter-connected lines comparable to the great railroad systems which have done so much in the

development of the population and resources of the country. Soon we may have an inter-connected system extending from Western Pennsylvania along the Appalachian mountains nearly to the Gulf of Mexico. All of these lines are built and connected up primarily for one purpose, namely, that of making money for the promoters and investors in these great systems. That is the first consideration and unless it can be shown without shadow of doubt that the promoter can make a profit, these gigantic enterprises are not undertaken.

No disparagement is intended of the promoter or the individual we would more properly call the "undertaker" if this useful word had not been commonly employed in another way. We owe a debt of gratitude to the promoter, the "superman" who by his skill, intelligence and especially his boldness has brought about the "superpower" system. Yet we must recognize that at the bottom his motives have been those of financial gain, but where successful it has been an intelligent and generally commendable self-interest. He has learned that in order to make a profit his enterprise must be of service and value to others and thus his secondary motive has been service, as a necessary incident to profit.

Contrasted with this is the term "giant power"; this also includes the building of great generating stations, of transmission lines and all of the devices included under the term "superpower" but here is the essential difference in the ultimate goal to be reached; that is the largest possible service to humanity. At the same time the advocates of giant power do not overlook the question of profit because they are well aware that no great developments of this kind can be maintained unless as a whole they are self-supporting and yield a fair profit to the men who take the risk. The emphasis is placed upon service and then upon fair profit rather than upon profit first and fair service second.

This distinction to some seems like the splitting of a hair and to be of no particular importance any more than the question is whether we "eat to live" or "live to eat." In



Water Power Plant of the Penn Central Power Company, above Huntingdon on the Juniata River, Pennsylvania.

either case we expect to live. Or it may be to them as unimportant as it is whether we have a republican form of government or a democratic. In either case the people are supposed to be the ultimate source of power and yet the determination of these questions may seriously involve our whole social structure. The distinction can, perhaps, be covered by the difference between "big profits and moderate service" as in contrast with this: "big service and moderate profits."

At the very outset we must recognize that the captains of industry of the country, the great bankers and other self-appointed dictators of finance and industry are thoroughly convinced that superpower and the ideas conveyed by it are the only logical and businesslike conception. They bring to their support the opinions of some engineers and economists; yet at the same time there are other men who venture to differ and to hold to the view that in the same way that the democratic form of government may be superior to a republican, the giant power idea if intelligently followed must in this outcome be of greater value to the human race than the superpower. Many financial leaders believe that the control and direction of these great powers cannot be safely entrusted to the public or to men chosen by the public, but must be left to a relatively small group of experts in development and finance, to the same class of men who, for example, during the past generation have built up the great railroad systems and who spread the network of inter-connected transportation throughout the country.

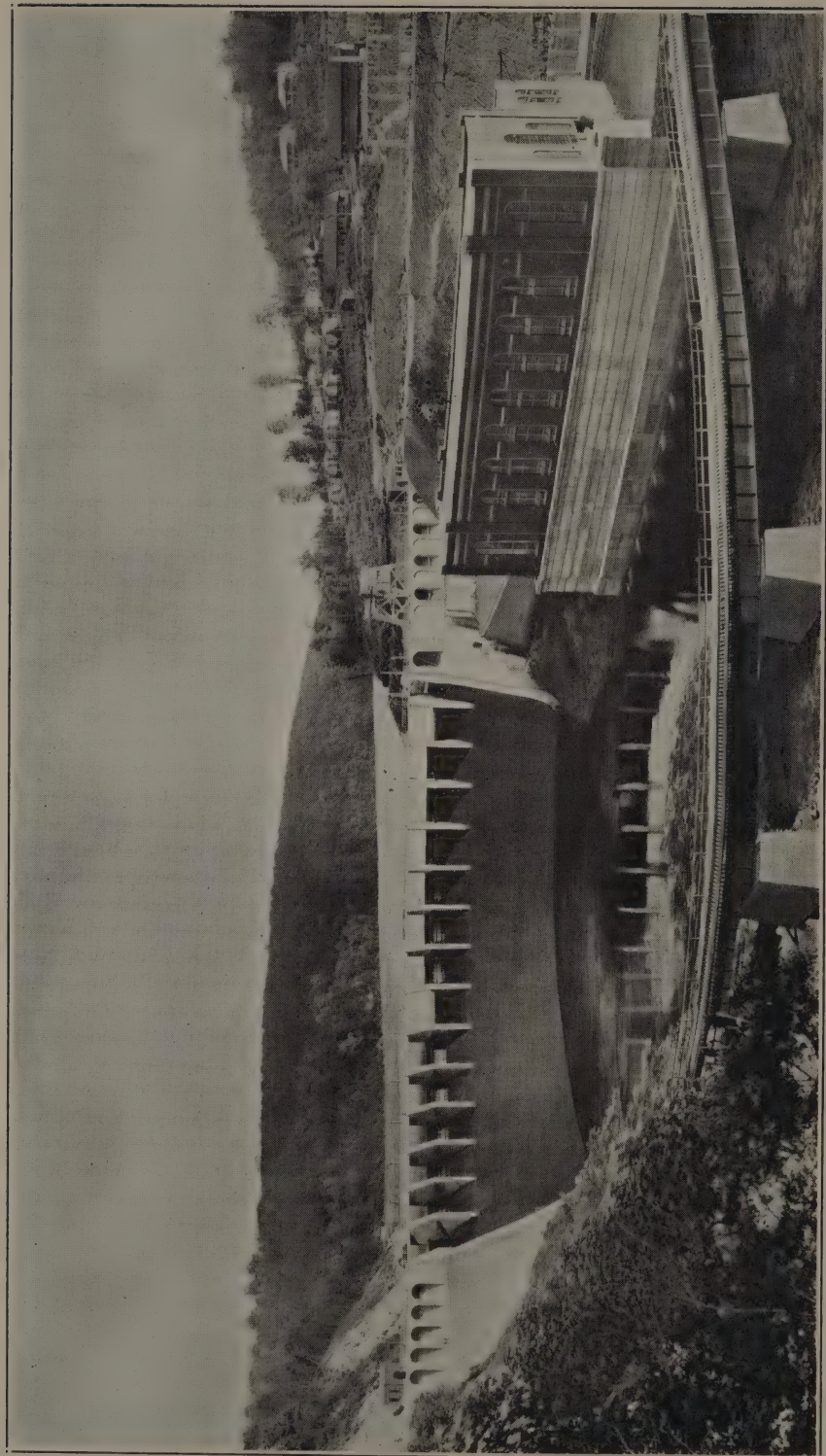
These leaders admit that in the past the promoters have made some errors and that, due to these, the public has been forced to adopt a system of control of the railroads through the Interstate Commerce Commission and railroad commissions in each State, but they claim that the lesson has been taught and that in the great developments of superpower there will be a larger consideration of public interest and that these giants of industry will be good giants in this relatively new enterprise, and will give more consideration to service

and less to making of profits than was true in the case of the railroads. In connection with this Mr. Herbert Hoover has been quoted as saying: "The majority of men who dominate the industry themselves belong to a new school of public understanding as to the responsibility of big business to the people."

There is, however, a group of thinkers who do not fully agree with this optimistic statement. They point to the fact that in these consolidations and interconnection of systems, while it is true that the public is better served and at more favorable terms than before, yet inordinate profits are being made and that there are dangers developing comparable to those which resulted from the uncontrolled consolidation of the railroads. They claim that the history of the past is being repeated, in slightly different form it is true, but that the public should be warned and should give heed to present conditions and tendencies; also that all of the added comforts, conveniences and general prosperity which are promised by the superpower conception can be had through giant power and with added security and many additional benefits.

In the short time which can be given to this subject only a few of the more simple points of difference between giant power and superpower can be mentioned. Perhaps the best way of approach may be through a recital of some of the criticisms, and as an illustration of the difference may be noted the underlying conception of what may be called the "giant power" system of our neighbor Ontario as contrasted with the superpower systems on the eastern side of Niagara river.

Starting primarily with the thought of service, the rates for such service in Ontario have been adjusted not with the first conception of the ordinary railroad and power manager of "the highest rates that the traffic will bear," but with a view to the widest service to the largest number. Especial attention has been given to the great group of smaller users particularly the farmers; they have been favored at the



Pincy Development on Clarion River, Pennsylvania.

expense of the larger users, a principle which is the exact reverse of that which ordinarily governs in superpower enterprises. That is to say, all expenses are covered and a fair return on the whole enterprise is assumed even though the charges to the many little users have been cut down to a few cents per unit. To offset this, a small and hardly noticeable increase is made to the larger users; by so doing it has been possible to widely extend the service. This is without crippling the larger user, the assumption being made, if he is a manufacturer, that his charge can be distributed over the business.

But the opponents of the giant power ideal say that this should not be done. They urge that if the larger user pays a fraction of a cent more for power than it actually costs he may be driven out of business by his competitors. This, however, is a matter of fact, determined by actual conditions; on a purely hypothetical basis either side may prove its case. The point is that it works! The advocates of the giant power idea insist that the service to thousands of small, widely distributed users is more valuable to the state and to the nation than the larger profits to a few men and that the returns as a whole are adequate to support the investment.

The critics of the ideals of giant power give as one of their objections the suggested subdivision of the whole matter into the three units of (1) generation, (2) transmission, and (3) distribution. They hold that these three are so closely connected as to be inseparable, and that no steps should be taken either through legislation or financial operations to treat each as a separate entity, or independent division of the subject. On the other hand the advocates of the giant power ideals hold that ultimately the largest economies will be produced and the public will be better served when there is such a division recognized legally as well as technically.

First, in the generation of power, the giant power people hold that this in itself, on a large scale, may be considered as being an entirely separate business. The construction of great

power works, whether hydroelectric or steam electric, involve peculiar problems similar to those of any great manufacturing plant where attention should be concentrated on the larger economies of production. For example, they urge that while the time has not yet fully arrived, there can be no doubt but that the manufacture of electricity by means of bituminous coal must and will be closely joined with by-product recovery, and that the time is arriving when the burning of raw coal without the recovery of by-products on a large scale will be recognized as wasteful and unwise. Pre-treatment plants on a large scale are actually in use.

To expedite the building and operation of these great producing systems there must be provided certain laws aiding in the acquisition of necessary rights of way and fuels, and many things must be considered from the standpoint of the economies of production as distinct from distribution.

Second, in a similar way the giant power advocates urge that special legislation and financial arrangements should be made to facilitate the planning and building of great transmission lines, needed to carry the exceptionally heavy loads, 220,000 k. w. or more, across the country from the generating stations to the centers of distribution, many of which are being developed. Instead of merely connecting up the extensions of existing systems, as is urged by the superpower people, they, the giant power advocates, would plan in advance for these main power lines, going by the most direct and feasible routes selected for this larger use, and not made subject to chance or to the temporary profit of some person or locality.

It would have been of immeasurable value to the people of the United States if in the planning of the early railroads, built during the time of great expansion, there had been some comprehension of the ultimate development of these trans-continental systems. It would have been possible at that time to have laid out a few main trunk line systems avoiding natural obstacles, securing the best grades, and planning less

with reference to local or personal profits and more with a broad view of the largest needs and greatest development of the country. Of course, it was impossible at that time to look thus far ahead, but in the case of electrical development we can do so. Already Mr. Frank G. Baum, one of the most far seeing experts has sketched out a series of transcontinental lines and has urged that construction be planned with a view to embodying these great ideas.

Third, comes the distribution of electric energy to the innumerable consumers, small as well as large.

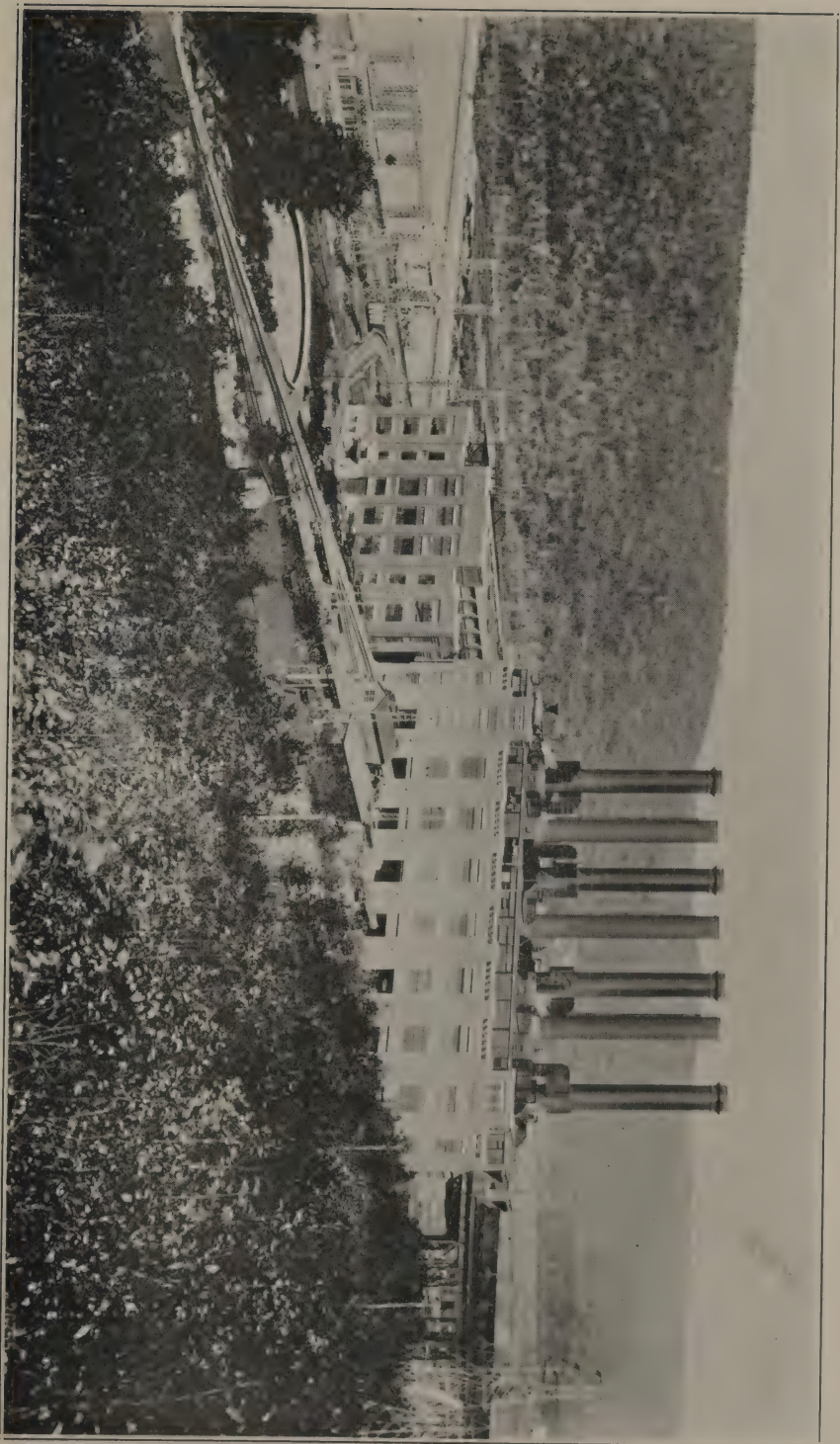
This is a business in itself, one which has already been well developed by the numerous local systems. The giant power plan contemplates supplying the existing centers of distribution with the cheapest possible power and leaving to local control the questions of ways and means of securing the best distribution. That is to say, the thought is to separate this retail system from the wholesale production and transmission of power, providing for each of these operations the necessary facilities and expediting the work of development by such legal enactments as may enable the most economical construction and operation. At present, for example, the laws are such in Pennsylvania that scores of corporations must be formed, usually one in each township or political division, and all of these ultimately combined with corresponding delay and expense. All of these archaic barriers should be removed and every possible aid given to the builders of these works.

At this point the question is asked as to whether the giant power plans contemplate public or private ownership or control. The answer is, that either may be had without interference with the fundamental ideal. Control of the public utilities of course will remain in the State, but the works may be financed and built with public or private capital according as necessity may arise, but without interfering with the working out of the principles of conservation or of the giant power program.

This also suggests another objection, namely, to the idea of recapture which is involved in the giant power scheme. It is proposed as in the case of the Federal Water Power Act that at the end of fifty years the franchise or concession given to the power companies may be terminated and if not renewed payment shall be made at the appraised value based upon prudent investment. Here again our captains of finance are opposed to the prospect of renewal of franchises at the end of fifty years fearing, as they say, that they may not receive fair treatment at the hands of the then existing State authorities.

Another objection to the giant power ideals is that the advocates of these urge the adoption of measures which will keep the control in the hands of the people most vitally interested either as investors or customers. We have gradually developed a system of finance and control by which all power is vested in a relatively small number of self-appointed dictators, men who through great ability or good fortune have been enabled to control enormous investments while themselves owning a small share and taking correspondingly little risk. The control of our power corporations, as in the case of other industries is becoming fiduciary rather than proprietary.

This has been possible by the fact that many of these great electrical corporations or consolidations depend for their money largely upon the sale of bonds, the holders of the bonds have no voting power: they look to the stockholders for payment of the interest on the bonds. There has also developed the system of preferred stock, by which the investors or holders of this stock surrender their right to control or vote, although they and the bondholders are furnishing most of the money or credit. This leaves the control in the hands of a relatively small number of holders of common stock. Experience has shown that even a small active minority of holders of this common stock, in the face of a somewhat indifferent or inactive majority, may control the



Pennsylvania Power and Light Co. Alto Steam Electric Station. Installed Generating Capacity 70,000 kw.

policy and may bring about consolidation of interest, interlocking directorates, and combinations with concealed profits beyond the power of the ordinary citizen to comprehend.

The assumption is made that these men who have the ability to thus control large affairs must necessarily consider the public interest in all of their manipulations. As a matter of fact this is usually true during the time of growth and development when new systems are being built, more money needed and great developments are taking place. Every incentive on the part of the promoters or captains of industry is to make a good showing to the present and prospective investors.

There comes a change, however, as has been shown in the history of the railroads and of great industries. When the development expenditures have practically ceased, and when stagnation ensues, there are no longer large promoter's profits to be made and then the promoter, as shown by past history, is tempted to become a re-organizer or even a wrecker, so that, in the rebuilding of these systems, new and larger profits may be made.

But it may be said that is the attitude of a by-gone generation. This is true, but it is safer to refer to these historical events. At the same time if a person cares to read the testimony of cases pending before the Interstate Commerce Commission on the proposed consolidations of certain railroads, he cannot get out of his mind the impression that similar wrecking is taking place to-day but in a more artistic manner.

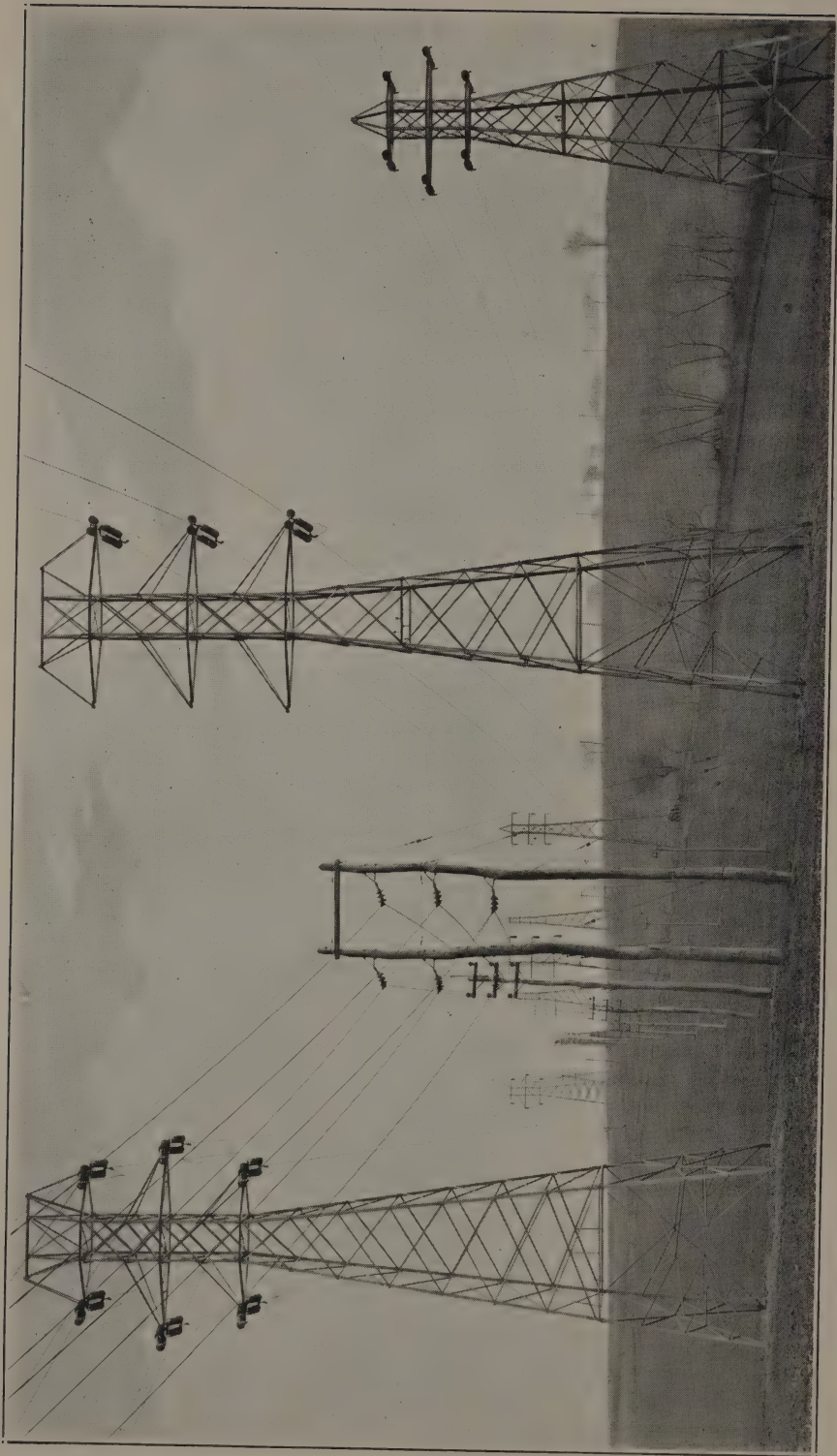
But what bearing has this particular discussion of giant power on your local problem of anthracite mining? It has much to do with it, particularly in revealing the tendencies of the present times. These tendencies, you—as an historical society—have the peculiar privilege and duty of pointing out. There is no doubt, as shown by recent history, that whether we proceed under a theory of giant power or superpower there will be a steadily increasing use of the power, and that

this will be developed with the highest possible degree of economy. It is inevitable that this will bring about a transformation of industry such as necessarily follows when each laborer in mine, field, or factory has at his disposal not only his own muscular strength, or that of a horse or two, but more than this the strength of an indefinite number of horses to be had through the pushing of a button.

Our whole trend of evolution, as indicated in historical narratives, is toward a steadily increasing use of power per worker, with corresponding increased output, a larger return to each worker, and a consequent reduction in cost of the output per unit. The real question is not so much as to whether this will take place, but as to how and when this largest economical use of power can be brought about. At present it is stated that only about four horse power per man is employed in and about the mines; this is mainly in hoisting or transportation. Relatively little machinery is used in loading coal and, in many respects, it is claimed, the anthracite industry is in what has been termed a medieval condition.

Few facts are available concerning these important matters, but it appears that in and around the anthracite mines about three million horse power are available or at the rate of one horse power per 225 tons produced annually. About one-third of this power is purchased: approximately twenty million tons of coal are used annually in making the power which is not purchased. There are fifteen thousand steam engines averaging one hundred thirty horse power each, and fifty thousand motors.

In spite of the general use of power about the anthracite mines, the production has decreased per man per day as given in the report of the United States Coal Commission. This is due largely to the increasing difficulties in thinner, deeper beds, the gains from better engineering being more than offset by the difficult natural conditions. From the mechanical standpoint it appears that the industry, relative to other occupations, is progressing slowly in its use of power, exemplified



Pennsylvania Power and Light Company, Transmission Lines on 215 ft. right-of-way. Siegfried-Allentown, Siegfried-Cherryhill, Siegfried-Bethlehem, Siegfried-North Bethlehem.

in the decrease of output per man. This slow development is due in part to the fact that this natural monopoly is in the hands of many owners. Although it is claimed that eight companies control nearly three-fourths of the production, there are 174 smaller companies, many of them termed as marginal, that is, on the edge between success and failure. Thus it happens that while a few companies, favored by the possession of thick and easily mined beds of coal are able to produce anthracite at a large profit, and might utilize profitably more power and machinery, yet a great number of the operators now mining coal with difficulty, and often at a loss, are unable to make progress. The overshadowing question is as to how, or in what way, the easily mined and therefore cheaper coals can be made to carry a part of the cost of extracting the more expensive or less valuable sizes. Unless or until some practical solution is brought to this problem the tendency will be to "take the cream and throw away the skim milk," violating the principles of conservation, and practically robbing future generations of what may be termed their proper share in this great natural monopoly.

Cheap power is one factor and possibly the greatest factor in the solution of these important questions of conservation. Time alone will show the importance of this factor, but we may safely predict that with an ample supply of power produced wholesale at the lowest possible cost, and wisely applied to reduce human drudgery, there will be a transformation in the conditions of living in the Wyoming Valley and elsewhere, not only in the homes and factories but perhaps more than all else in the mines on which your prosperity depends.

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